Claims

1. A method of treating a subject to attach microparticles to a skin surface of the subject comprising

contacting the skin surface with microparticles having surface available transglutaminase substrate reactive groups in an amount sufficient to attach the microparticles to the skin surface in the presence of endogenous transglutaminase,

allowing the microparticles to remain in contact with the skin surface for a time sufficient to permit a layer of microparticles to covalently attach to the skin surface.

2. The method of claim 1, wherein the surface available transglutaminase substrate reactive groups are lysines.

3. The method of claim 1, wherein the surface available transglutaminase substrate reactive groups are glutamines.

4. The method of claim 1, wherein the layer of microparticles is non-planar.

5. The method of claim 1, wherein the microparticles further comprise an active agent.

6. The method of claim 5, wherein the active agent is a non-nucleic acid active agent.

7. The method of claim 5, wherein the active agent is a non-protein active agent.

8. The method of claim 5, wherein the active agent is selected from the group consisting of a cosmetic agent, a bulking agent, a hair conditioning agent, a hair fixative, a sunscreen agent, a moisturizing agent, a depilatory agent, an anti-nerve gas agent, a film forming agent, a vitamin, an insect repellant, a coloring agent, a pharmaceutical agent, a ligand-receptor complex and a receptor of a ligand-receptor complex.

9. The method of claim 5, wherein the active agent is not itself a substrate of transglutaminase.

10. The method of claim 1, wherein the microparticles further comprise a synthetic polymer.

11. The method of claim 10, wherein the synthetic polymer is latex.

12. The method of claim 10, wherein the synthetic polymer is polystyrene.

13. The method of claim 1, wherein the microparticles are porous.

14. The method of claim 1, wherein the microparticles are 100 nm to 500 nm in size.

15. The method of claim 1, wherein the microparticles are 20 nm to 35 nm in size.

16. The method of claim 1, wherein the microparticles are non-biodegradable.

17. The method of claim 1, wherein the microparticles are detergent insoluble.

18. The method of claim 1, wherein the transglutaminase substrate reactive groups are part of a polymer.

19. The method of claim 18, wherein the polymer is covalently attached to the microparticle.

20. The method of claim 18, wherein the polymer is comprised of at least 50% lysines.

21. The method of claim 18, wherein the polymer is lysine-rich at a surface available terminus.

22. The method of claim 18, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least two contiguous linked lysines,

(b) at least three contiguous linked lysines,

(c) at least four contiguous linked lysines, and

(d) at least five contiguous linked lysines.

23. The method of claim 18, wherein the polymer is comprised of at least 50% glutamines.

24. The method of claim 18, wherein the polymer is glutamine-rich at a surface available terminus.

25. The method of claim 18, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least five contiguous linked glutamines,

(b) at least ten contiguous linked glutamines,

(c) at least fifteen contiguous linked glutamines, and

(d) at least twenty contiguous linked glutamines.

26. A method of treating a subject to attach microparticles to a skin surface of the subject comprising

contacting the skin surface with microparticles having surface available transglutaminase substrate reactive groups in an amount sufficient to attach the microparticles to the skin surface in the presence of exogenous transglutaminase,

applying exogenous transglutaminase to the skin surface, and

allowing the microparticles and exogenous transglutaminase to remain in contact with the skin surface for a time sufficient to permit a layer of microparticles to covalently attach to the skin surface.

27. The method of claim 26, wherein the surface available transglutaminase substrate reactive groups are lysines.

28. The method of claim 26, wherein the surface available transglutaminase substrate

reactive groups are glutamines.

29. The method of claim 26, wherein the layer of microparticles is non-planar.

30. The method of claim 26, wherein the microparticles further comprise an active agent

31. The method of claim 30, wherein the active agent is a non-nucleic acid active agent.

32. The method of claim 30, wherein the active agent is a non-protein active agent.

33. The method of claim 30, wherein the active agent is selected from the group consisting of a cosmetic agent, a bulking agent, a hair conditioning agent, a hair fixative, a sunscreen agent, a moisturizing agent, a depilatory agent, an anti-nerve gas agent, a film forming agent, a vitamin, an insect repellant, a coloring agent, a pharmaceutical agent, a ligand-receptor complex and a receptor of a ligand-receptor complex.

34. The method of claim 30, wherein the active agent is not itself a substrate of transglutaminase.

35. The method of claim 26, wherein the microparticles further comprise a synthetic polymer.

36. The method of claim 35, wherein the synthetic polymer is latex.

37. The method of claim 35, wherein the synthetic polymer is polystyrene.

38. The method of claim 26, wherein the microparticles are porous.

39. The method of claim 26, wherein the microparticles are 100 nm to 500 nm in size.

40. The method of claim 26, wherein the microparticles are 20 nm to 35 nm in size.

41. The method of claim 26, wherein the microparticles are non-biodegradable.

42. The method of claim 26, wherein the microparticles are detergent insoluble.

43. The method of claim 26, wherein the transglutaminase substrate reactive groups are part of a polymer.

44. The method of claim 43, wherein the polymer is covalently attached to the microparticle.

45. The method of claim 43, wherein the polymer is comprised of at least 50% lysines.

46. The method of claim 43, wherein the polymer is lysine-rich at a surface available terminus.

47. The method of claim 43, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least two contiguous linked lysines,
(b) at least three contiguous linked lysines,
(c) at least four contiguous linked lysines, and
(d) at least five contiguous linked lysines.

48. The method of claim 43, wherein the polymer is comprised of at least 50% glutamines.

49. The method of claim 43, wherein the polymer is glutamine-rich at a surface available terminus.

50. The method of claim 43, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least five contiguous linked glutamines,

(b) at least ten contiguous linked glutamines,

(c) at least fifteen contiguous linked glutamines, and

(d) at least twenty contiguous linked glutamines.

51. A kit comprising

a microparticle comprising surface available transglutaminase substrate reactive groups in an amount sufficient to attach the microparticle to a skin surface in the presence of endogenous transglutaminase, and

instructions for topically administering the microparticle to a skin surface.

52. The kit of claim 51, wherein the surface available transglutaminase substrate reactive groups are lysines.

53. The kit of claim 51, wherein the surface available transglutaminase substrate reactive groups are glutamines.

54. The kit of claim 51, wherein the microparticle further comprises an active agent

55. The kit of claim 54, wherein the active agent is a non-nucleic acid active agent.

56. The kit of claim 54, wherein the active agent is a non-protein active agent.

57. The kit of claim 54, wherein the active agent is selected from the group consisting of a cosmetic agent, a bulking agent, a hair conditioning agent, a hair fixative, a sunscreen agent, a moisturizing agent, a depilatory agent, an anti-nerve gas agent, a film forming agent, a vitamin, an insect repellant, a coloring agent, a pharmaceutical agent, a ligand-receptor complex and a receptor of a ligand-receptor complex.

58. The kit of claim 54, wherein the active agent is not itself a substrate of transglutaminase.

59. The kit of claim 51, wherein the microparticle further comprises a synthetic polymer.

60. The kit of claim 59, wherein the synthetic polymer is latex.

61. The kit of claim 59, wherein the synthetic polymer is polystyrene.

62. The kit of claim 51, wherein the microparticle is porous.

63. The kit of claim 51, wherein the microparticle is 100 nm to 500 nm in size.

64. The kit of claim 51, wherein the microparticle is 20 nm to 35 nm in size.

65. The kit of claim 51, wherein the microparticle is non-biodegradable.

66. The kit of claim 51, wherein the microparticle is detergent insoluble.

67. The kit of claim 51, wherein the surface available transglutaminase substrate reactive groups are part of a polymer.

68. The kit of claim 67, wherein the polymer is covalently attached to the microparticle.

69. The kit of claim 67, wherein the polymer is comprised of at least 50% lysines.

70. The kit of claim 67, wherein the polymer is lysine-rich at a surface available terminus.

71. The kit of claim 67, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least two contiguous linked lysines,

(b) at least three contiguous linked lysines,

(c) at least four contiguous linked lysines, and

(d) at least five contiguous linked lysines.

72. The kit of claim 67, wherein the polymer is comprised of at least 50% glutamines.

73. The kit of claim 67, wherein the polymer is glutamine-rich at a surface available terminus.

74. The kit of claim 67, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least five contiguous linked glutamines,

(b) at least ten contiguous linked glutamines,

(c) at least fifteen contiguous linked glutamines, and

(d) at least twenty contiguous linked glutamines.

75. The kit of claim 51, wherein the microparticle is provided in a topically administered form selected from the group consisting of an ointment, an aerosol, a gel, and a lotion.

76. A kit comprising

a microparticle having surface available transglutaminase substrate reactive groups in an amount sufficient to attach the microparticle to a skin surface in the presence of exogenous transglutaminase, and

instructions for topically administering the microparticle and transglutaminase to a skin surface.

77. The kit of claim 76, wherein the kit further comprises transglutaminase.

78. The kit of claim 76, wherein the surface available transglutaminase substrate reactive groups are lysines.

79. The kit of claim 76, wherein the surface available transglutaminase substrate reactive groups are glutamines.

80. The kit of claim 76, wherein the microparticle further comprises an active agent

81. The kit of claim 80, wherein the active agent is a non-nucleic acid active agent.

82. The kit of claim 80, wherein the active agent is a non-protein active agent.

83. The kit of claim 80, wherein the active agent is selected from the group consisting of a cosmetic agent, a bulking agent, a hair conditioning agent, a hair fixative, a sunscreen agent, a moisturizing agent, a depilatory agent, an anti-nerve gas agent, a film forming agent, a vitamin, an insect repellant, a coloring agent, a pharmaceutical agent, a ligand-receptor complex and a receptor of a ligand-receptor complex.

84. The kit of claim 80, wherein the active agent is not itself a substrate of transglutaminase.

85. The kit of claim 76, wherein the microparticle further comprises a synthetic polymer.

86. The kit of claim 85, wherein the synthetic polymer is latex.

87. The kit of claim 85, wherein the synthetic polymer is polystyrene.

88. The kit of claim 76, wherein the microparticle is porous.

89. The kit of claim 76, wherein the microparticle is 100 nm to 500 nm in size.

90. The kit of claim 76, wherein the microparticle is 20 nm and 35 nm in size.

91. The kit of claim 76, wherein the microparticle is non-biodegradable.

92. The kit of claim 76, wherein the microparticle is detergent insoluble.

93. The kit of claim 76, wherein the transglutaminase substrate reactive groups are part of a polymer.

94. The kit of claim 93, wherein the polymer is covalently attached to the microparticle.

95. The kit of claim 93, wherein the polymer is comprised of at least 50% lysines.

96. The kit of claim 93, wherein the polymer is lysine-rich at a surface available terminus.

97. The kit of claim 93, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least two contiguous linked lysines,
(b) at least three contiguous linked lysines,
(c) at least four contiguous linked lysines, and
(d) at least five contiguous linked lysines.

98. The kit of claim 93, wherein the polymer is comprised of at least 50% glutamines.

99. The kit of claim 93, wherein the polymer is glutamine-rich at a surface available terminus.

100. The kit of claim 93, wherein the polymer comprises a polymer selected from the group consisting of:

(a) at least five contiguous linked glutamines,
(b) at least ten contiguous linked glutamines,
(c) at least fifteen contiguous linked glutamines, and
(d) at least twenty contiguous linked glutamines.

101. The kit of claim 76, wherein the composition is in a topically administered form selected from the group consisting of an ointment, an aerosol, a gel, and a lotion.

102. A composition comprising

a microparticle comprising an active agent and a lysine-rich polymer having transglutaminase substrate reactive groups, wherein the microparticle is non-biodegradable, and the transglutaminase substrate reactive groups are surface available.

103. The composition of claim 102, wherein the active agent is a non-nucleic acid active agent.

104. The composition of claim 102, wherein the active agent is a non-protein active agent.

105. The composition of claim 102, wherein the active agent is selected from the group consisting of a cosmetic agent, a bulking agent, a hair conditioning agent, a hair fixative, a sunscreen agent, a moisturizing agent, a depilatory agent, an anti-nerve gas agent, a film forming agent, a vitamin, an insect repellant, a coloring agent, a pharmaceutical agent, a ligand-receptor complex and a receptor of a ligand-receptor complex.

106. The composition of claim 102, wherein the active agent is not itself a substrate of transglutaminase.

107. The composition of claim 102, wherein the microparticle further comprises a synthetic polymer.

108. The composition of claim 107, wherein the synthetic polymer is latex.

109. The composition of claim 107, wherein the synthetic polymer is polystyrene.

110. The composition of claim 107, wherein the lysine-rich polymer is covalently linked to the synthetic polymer.

111. The composition of claim 102, wherein the microparticle is a microsphere.

112. The composition of claim 102, wherein the microparticle is porous.

113. The composition of claim 102, wherein the microparticle is 100 nm to 500 nm in size.

114. The composition of claim 102, wherein the microparticle is 20 nm to 35 nm in size.

115. The composition of claim 102, wherein the microparticle is non-biodegradable.

116. The composition of claim 102, wherein the microparticle is detergent insoluble.

117. The composition of claim 102, wherein the transglutaminase substrate reactive groups are surface available in an amount sufficient to attach the microparticle to a skin surface in the presence of endogenous transglutaminase.

118. The composition of claim 102, wherein the transglutaminase substrate reactive groups are surface available in an amount sufficient to attach the microparticle to a skin surface in the presence of exogenous transglutaminase.

119. The composition of claim 102, wherein the lysine-rich polymer comprises a polymer of amino acids and wherein at least 50% of the amino acids are lysine.

120. The composition of claim 102, wherein the lysine-rich polymer is lysine-rich at a surface available terminus.

121. The composition of claim 102, wherein the lysine-rich polymer is covalently attached to the microparticle.

122. The composition of claim 102, wherein the lysine-rich polymer comprises a polymer selected from the group consisting of:

(a) at least two contiguous linked lysines,

(b) at least three contiguous linked lysines,

(c) at least four contiguous linked lysines, and

(d) at least five contiguous linked lysines.

123. A composition comprising

a microparticle comprising an active agent and a glutamine-rich polymer having transglutaminase substrate reactive groups, wherein the transglutaminase substrate reactive groups are surface available.

124. The composition of claim 123, wherein the transglutaminase substrate reactive groups are surface available in an amount sufficient to attach the microparticle to a skin surface in the presence of endogenous transglutaminase.

125. The composition of claim 123, wherein the transglutaminase substrate reactive groups are surface available in an amount sufficient to attach the microparticle to a skin surface in the presence of exogenous transglutaminase.

126. The composition of claim 123, wherein the microparticle is non-biodegradable.

127. The composition of claim 123, wherein the microparticle is detergent insoluble.

128. The composition of claim 123, wherein the microparticle is 100 nm to 500 nm in size.

129. The composition of claim 123, wherein the microparticle is 20 nm to 35 nm in size.

130. The composition of claim 123, wherein the microparticle is porous.

131. The composition of claim 123, wherein the microparticle further comprises a synthetic polymer.

132. The composition of claim 131, wherein the synthetic polymer is non-biodegradable.

133. The composition of claim 131, wherein the synthetic polymer is latex.

134. The composition of claim 131, wherein the synthetic polymer is polystyrene.

135. The composition of claim 131, wherein the glutamine-rich polymer is covalently linked to the synthetic polymer.

136. The composition of claim 123, wherein the glutamine-rich polymer comprises a polymer of amino acids and wherein at least 20% of the amino acids are glutamines.

137. The composition of claim 123, wherein the glutamine-rich polymer is glutamine-rich at a surface available terminus.

138. The composition of claim 123, wherein the glutamine-rich polymer is covalently attached to the microparticle.

139. The composition of claim 123, wherein the glutamine-rich polymer comprises a polymer selected from the group consisting of:

(a) at least five contiguous linked glutamines,

(b) at least ten contiguous linked glutamines,

(c) at least fifteen contiguous linked glutamines, and

(d) at least twenty contiguous linked glutamines.

140. The composition of claim 123, wherein the active agent is not itself a substrate of transglutaminase.

141. The composition of claim 123, wherein the active agent is selected from the group consisting of a cosmetic agent, a bulking agent, a hair conditioning agent, a hair fixative, a sunscreen agent, a moisturizing agent, a depilatory agent, an anti-nerve gas agent, a film forming agent, a vitamin, an insect repellant, a coloring agent, a pharmaceutical agent, a ligand-receptor complex and a receptor of a ligand-receptor complex.

143. The composition of claim 123, wherein the active agent is a non-protein active agent.

144. A composition comprising
a microparticle comprising a non-nucleic acid active agent, and
covalently attached surface available transglutaminase substrate reactive groups,
wherein the microparticle is 100 nm to 500 nm in size.

145. The composition of claim 144, wherein the surface available transglutaminase substrate reactive groups are free pendant groups.